Remarks:

It is understood that the Examiner has not entered the Amendment that was submitted on August 8, 2003. Applicant requests that, instead of entering that amendment, this Amendment should be entered for the continued prosecution of this Application.

Applicant appreciates the Examiner's indication that claims 15 and 18-21 contain allowable subject matter. Claims 15 and 18 now have been amended to put them into independent form, so claims 15 and 18-21 should now be in condition for allowance. The language of the claims as they currently stand has been slightly revised from what they were before. The word "safety" has been removed from the phrase "safety rim". Applicant will rely on other language in the claim, including the U-shaped cross-section, to define the shape of the rim. The language "has a diameter **that** spans" has been changed to "has a diameter **and** spans". The reason for this change is that, as described on page 14, beginning on line 1 of the specification, the diameter is defined to be the largest distance across the ball. Depending upon the configuration of the tire and the balls, such as in the case of a wide tire, the diameter of the ball may be oriented in one direction, say, from one edge of the tire toward the other edge, and another dimension of the ball is oriented in another direction, say from the inner radius of the tire toward the outer radius, so it might not be the diameter alone that spans the space between the tire and the rim but rather a combination of the dimensions of the ball that spans that space. In any case, the claims still include a limitation that the individual ball spans the space, meaning that there is only room for a single layer of balls between the tire and rim, both in the width and height directions. This distinguishes the claimed invention from the prior art references that used a large number of small diameter balls, allowing for many layers of balls between the tire and the rim.

Claim 1 has been amended to add the requirement that at least some of the balls are independent of the tire and rim and are free to shift circumferentially relative to the safety rim and the tire, so that, if one of the balls is punctured and deflates, others of the balls can shift circumferentially to help fill the space created by the deflated ball in order to continue providing support to the tire. It has also been amended to make it clear that the safety rim includes a one-piece ring that has a generally U-shaped cross-section with left and right recesses. One paragraph of the specification has been amended and another has been added to provide language as a basis for the claim amendment. This does not add new matter, as it simply describes what is shown in the drawings.

In much of the prior art, the balls are not independent of the tire and rim and free to shift circumferentially relative to the tire and rim in order to redistribute themselves to help fill a gap if one of the balls is punctured and goes flat as is now recited in claim 1. For example, the Peck and Grubb references have spacers or body members with pockets, which keep the balls in a fixed position relative to the rim and tire, so the balls are not

able to independently shift circumferentially to fill a space created by a deflated ball. In Peck, the body members 5, 6 form the pockets 8. In Grubb, the spacers 6, 6a also form pockets to hold the balls in a fixed position relative to the tire and rim.

Many other prior art references also prevent the balls from independently shifting circumferentially. For example, in the Welch reference, the balls are at least temporarily fastened in position until the gel sets up, and then, once the gel has set, the balls cannot move independently relative to the tire and rim. In Hill, the balls are fixed to the rim by axles E. In Mains, the balls are fixed to the rim with inlet tubes 10. In Evans and Jacobs, the balls rest in individual pockets held in position by spacers. In Harris, the balls are secured by their valves. In Booharin, the individual balls are held in position by fixed spacers. The balls in these prior art references cannot move to help fill a gap created if one of the balls goes flat.

In contrast, as recited in claim 1, and as shown in Figures 3, 16, and 17, the balls are independent of the tire and rim and are free to shift in the circumferential direction to help fill a gap that would be formed if one of the balls went flat. Even if rim locks were used, the balls still could shift within the space between two adjacent rim locks to fill a gap formed by a deflated ball.

Of the Krum, Peck, and Grubb references, only the Krum reference does not prevent the balls from shifting circumferentially. Although Krum allows the balls to shift circumferentially, it still would not be obvious to mount the Krum design onto a safety rim to make the invention recited in claim 1. The attached **declaration of Wade Summers** (attachment #1) explains why it would be both undesirable and impossible to mount the Krum design onto a safety rim. To summarize the declaration, the Krum design would not be acceptable to consumers, because it would provide a very rough ride, with a bump every time one of the rigid portions of the elements "C" hit bottom. Because it would provide such a rough ride, people skilled in the art would reject it and would not be inclined to try to mount it on a new type of rim. Also, it would be impossible to mount the Krum design onto a safety rim for two reasons. First, the inflatable elements C of Krum, which are used to compress the balls, could not be inserted between the tire and the rim, because there is not enough space to insert them when using a safety rim including a one-piece ring as claimed. In addition, if the inflatable elements "C" were somehow miraculously inserted into the space between the tire and the rim, they would prevent the tire bead from recessing a sufficient distance into the rim to be able to mount the tire onto the rim. Thus, the tire could not be mounted on the safety rim if the inflatable elements "C" of Krum were used.

It should be noted that Krum uses a multi-part rim, as shown in Figure 3, which does not require the edge of the tire to fit over the rim as is required when a one-piece safety rim is used. While Krum states that a "clencher" tire casing or **other suitable construction**, and a rim of **any suitable kind** may be used, it should be noted that one-piece safety rims had not yet been invented at the time Krum made that statement, so he certainly could not have had a one-piece safety rim in mind as being a "suitable kind" of rim.

While one-piece safety rims certainly are well-known now, it cannot be considered obvious to mount the Krum design on such a rim for the reasons explained above and in the Summer declaration.

Longfelt need:

It also should be noted that the problem of punctured tires and blow-outs is a longstanding problem, for which tremendous amounts of resources have been spent in search of a solution for over one hundred years, and the present invention solves that problem. The Krum reference has been available since 1910, and safety rims have been used for over fifty years. Given the amount of resources that have been spent trying to solve the problem of tire blow-outs and tire failures, if it were obvious to modify Krum to make the present invention, it would have been done long ago.

As evidence of the longfelt need, a history of tires (attachment #2) is attached hereto. This history indicates that solving the problem of punctures goes back to the beginning of tires, at least as early as the 1890's. The history lists numerous patents for mending punctured tires dating from the 1890's. Since the problem of punctures was not solved, the efforts continued.

Attachment #3 shows the front pages of numerous more recent patents, which have tried to solve the problem of tire blow-outs. Some involve the use of inserts. Some provide mechanisms for automatic sealing of a puncture. None have been very effective at solving the problem. These numerous patents, many of which are assigned to large companies, including B.F. Goodrich, Sumitomo Rubber Industries, Ltd., Uniroyal, Michelin, Firestone, Dunlop, Ohtsu Tire & Rubber Co., Goodyear, Bridgestone, Yokohama Rubber Co., Bayer, and General Tire & Rubber, provide a clear indication that substantial resources have been spent trying to solve the problem that is solved by the present invention.

Attachment #4 provides evidence that tire blow-outs are responsible for thousands of crashes and hundreds of fatalities each year, including both automobile crashes and airplane crashes.

Attachment #5 includes data concerning damages that have been awarded to some of the victims of these crashes. For example according to the web site of the Colson Hicks law firm in Florida, a girl in Florida was awarded $30.7 million after being left in a vegetative state in a crash caused by an exploding tire. An article in the Detroit News says that the cases are settling for "no less than $1 million and usually between $3 million and $6 million in the majority of cases where a death is involved. Settlements of $10 million or more are not uncommon in cases where paralysis is involved because of the high cost of medical bills." An article published in the St. Petersburg Times reports a $7.5 million settlement from Bridgestone Tires and a $6 million settlement from Ford to the family of Marisa Rodriguez, due to an accident caused by tire failure.

Given the longfelt need for a solution to the problem of tire failure and tire blow-outs, the tremendous resources that have been spent trying to solve that problem over the course of many years, as described above and as documented in the attachments #2-5, and the fact that both Krum and safety rims have been known for over fifty years, one would have to conclude that, if the claimed combination were obvious, it would have been made long ago.

It should also be noted that the Summers design has been very successful both in static tests and in actual races of all-terrain vehicles and off-road motorcycles, as explained in the Summers declaration. It provides a substantial advantage over the designs currently in use, which are the best-performing designs that the manufacturers have been able to offer.

For the foregoing reasons, the invention recited in claim 1 is both novel and unobvious in view of the prior art.

Claim 2 depends from claim 1 and adds that there is a main valve extending through the rim to permit gas to be inserted into and removed from the hollow space that is formed between the tire and the rim through the main valve.

Claim 3 depends from claim 1 and recites that the inflated ball has its own valve.

Claim 4 depends from claim 2 and recites that the inflated ball has its own individual valve.

Claim 5 depends from claim 4 and adds a rim lock.

Claim 6 depends from claim 1 and recites that the balls have different internal pressures, with some balls having a lower pressure and others having a substantially higher pressure, such that the lower pressure balls compress more under load than the higher pressure balls, with the lower pressure balls and higher pressure balls being arranged at intervals in order to create an effect similar to providing knobs on the tire. As was explained in the specification, on page 13, beginning on line 3,

"While the preferred embodiment of the invention, as shown in Figure 3, has all the balls 18 inflated to approximately the same pressure, an alternative would be to inflate the balls 18 to different pressures, for example, alternating from a higher pressure in one ball to a lower pressure in the next adjacent ball, back to a higher pressure in the next ball, and so forth. This would have a similar effect to providing knobs on the tire 12, in that the lower pressure balls would compress more under load than the higher pressure balls, causing the portions of the tire 12 supported by the higher pressure balls to dig into the support surface, giving the resulting assembly very good traction properties."

Clearly, based on this description, claim 6 is not intended to claim the insignificant differences in pressure that occur with typical manufacturing tolerances, in

which the balls are inflated to "approximately the same pressure". Claim 6 intends substantial differences in pressure, and with the differences being arranged in predetermined intervals, such as, for example, three adjacent balls at a low pressure and then the next two adjacent balls at a high pressure, followed by three balls at a low pressure, and so forth, so that the lower pressure balls compress more under load than the higher pressure balls, with the pressure variations serving a function similar to providing knobs on the outside of the tire, so as to provide improved traction properties. This has not been taught or suggested in the art.

Claim 7 depends from claim 1 and adds an inflatable tube between the balls and the rim, with the inflatable tube including a main valve that is accessible from outside the rim. In this design, each individual ball still spans the space between the tire and rim, meaning that there is only a single layer of balls between the tire and rim, not multiple layers, and, in addition, the tube can be inflated between the balls and the rim.

Claim 8 depends from claim 1 and recites that the balls are made of polyurethane sheets that are welded together and have individual valves. Such balls, made of welded-together sheets and with individual valves have not been taught for use in such a combination.

Claim 9 is an independent claim, which has been amended to add the limitation that at least some of the balls are independent of the tire and rim and free to shift circumferentially relative to the tire and rim. As was explained with respect to claim 1, this distinguishes the claimed invention from much of the prior art. While the Krum reference does permit the balls to independently shift in a circumferential direction, it would be impossible to assemble this design onto a safety rim, as was explained earlier. Thus, the assembly recited in claim 9 is both novel and unobvious in view of the prior art.

Claim 10 depends from claim 9 and recites that the balls are made of welded together sheets, which, as explained above, has not been taught for such an assembly.

Claim 11 depends from claim 10 and further that the sheets are made of polyurethane.

Claim 12 depends from claim 9 and recites that the balls are inflated to substantially different internal pressures. Again, the use of substantially different pressures provides an advantage that is not taught or suggested by the prior art.

Claim 13 depends from claim 9 and adds the use of a rim lock.

Claim 14 depends from claim 9 and adds the inflatable tube between the balls and the rim, with a valve accessible through the rim for inflating the tube.

Claim 16 depends from claim 9 and includes specific details of the characteristics of the balls that are not taught or suggested in the prior art.

Claim 17 depends from claim 1 and recites that the balls are made of polyurethane sheets that are welded together.

Claim 22 has been added. This claim recites the rim having a generally U-shaped cross-section, an inner surface and an outer surface, and defining left and right recesses on its inner surface, a tire mounted on the rim, including left and right edges received in the left and right recesses, a plurality of inflated balls located in the hollow space between the tire and rim, wherein each ball spans the space between the tire and the rim, at least some of the balls being independent of said tire and rim and free to shift circumferentially relative to said tire and rim, and wherein there is nothing more rigid than the balls that also spans the space between the rim and tire. In addition to the type of rim that is claimed, this claim can be distinguished from Krum, because it requires that there be nothing more rigid than the balls spanning the space between the rim and tire. In Krum, the rigid portions of the inflatable members "C" span that space, which, as explained earlier, would provide a very rough, undesirable ride. The present invention avoids that problem. While the present invention may be used in conjunction with a rigid rim lock, as shown in Figure 4, the rim lock does not span the space between the tire and rim and would not interfere with the type of ride provided by the balls. Therefore, this claim recites an invention that is both novel and unobvious in view of the prior art.

As all the claims define an invention that is both novel and unobvious in view of the prior art, Applicant respectfully requests allowance of all the claims now pending in the present application. If there are any further problems with this application, Applicant's attorney would appreciate a phone call from the Examiner to help expedite their resolution.

The Patent Office is authorized to charge any additional required fees and to credit any overpayments to deposit account 500265.

Respectfully submitted,

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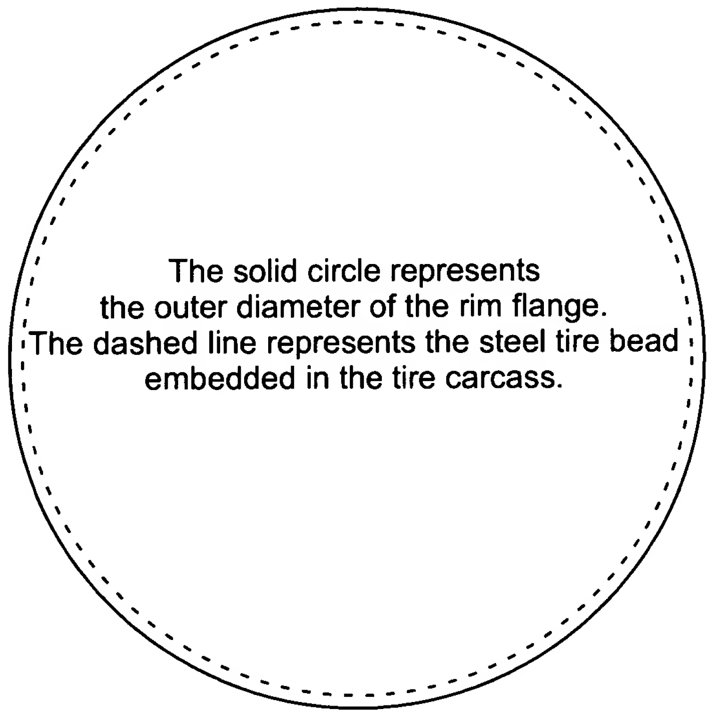
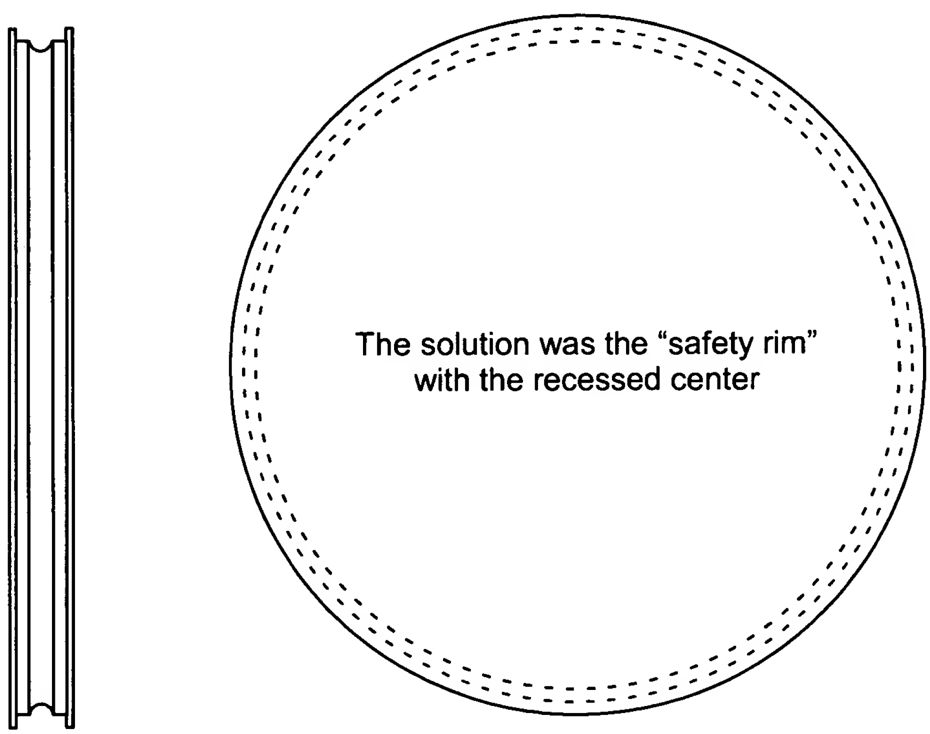
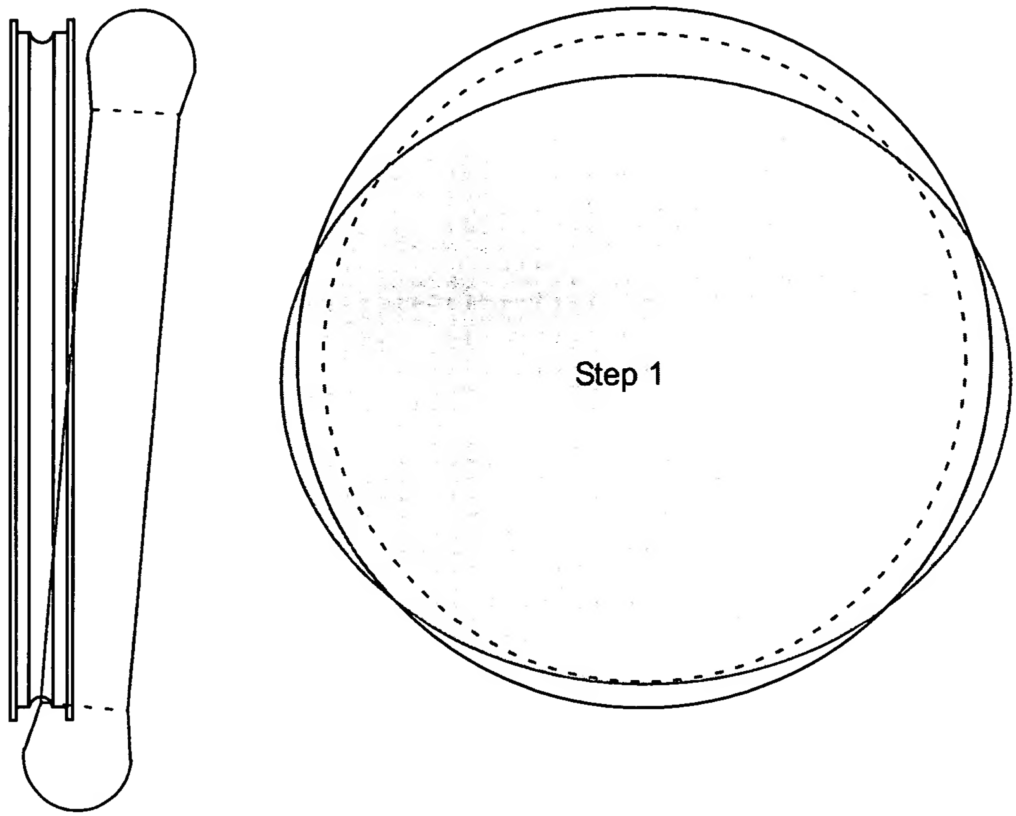
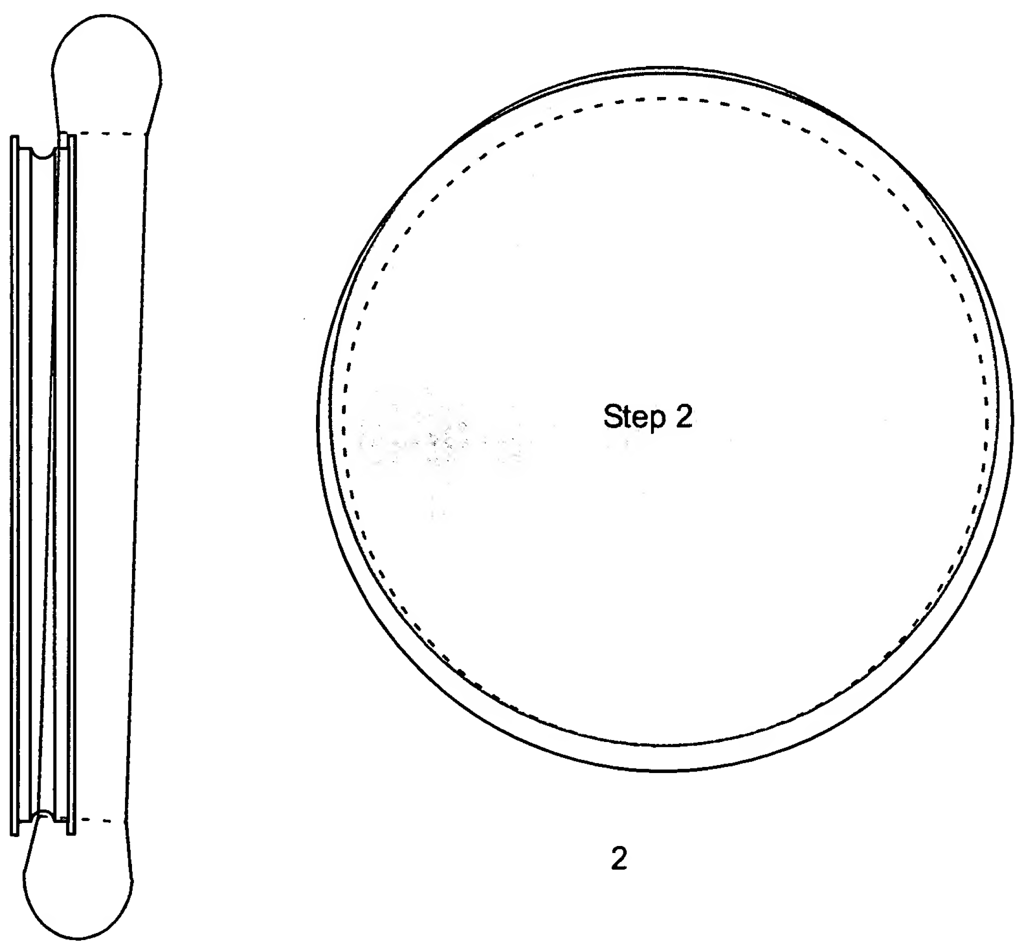
The Classical Tire mounting problem is that one must be able to install the dashed circle over the solid circle.
The solid circle is rigid and represents the rim flange outer diameter.
The dashed circle represents the flexible but in-extensible steel bead embedded in the tire carcass.



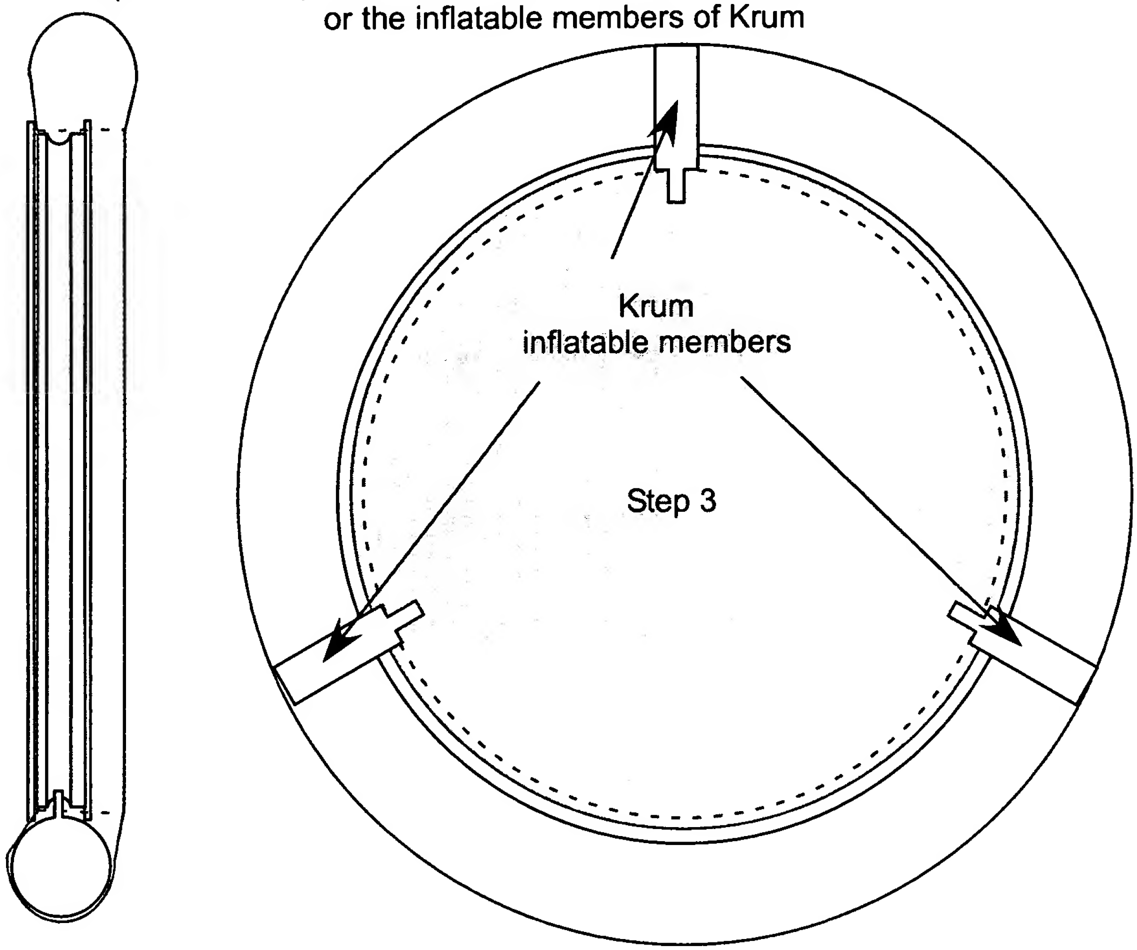


The recess allows the flexible yet in-extensible bead 1) to be worked over the flange and into the recess 2) leaving enough remaining perimeter to be able to be worked over the remainder of the rim flange.





The first tire bead is now worked over the rim flange at it is only at this point where
components that pass through the rim can be installed such as rim locks
or the inflatable members of Krum

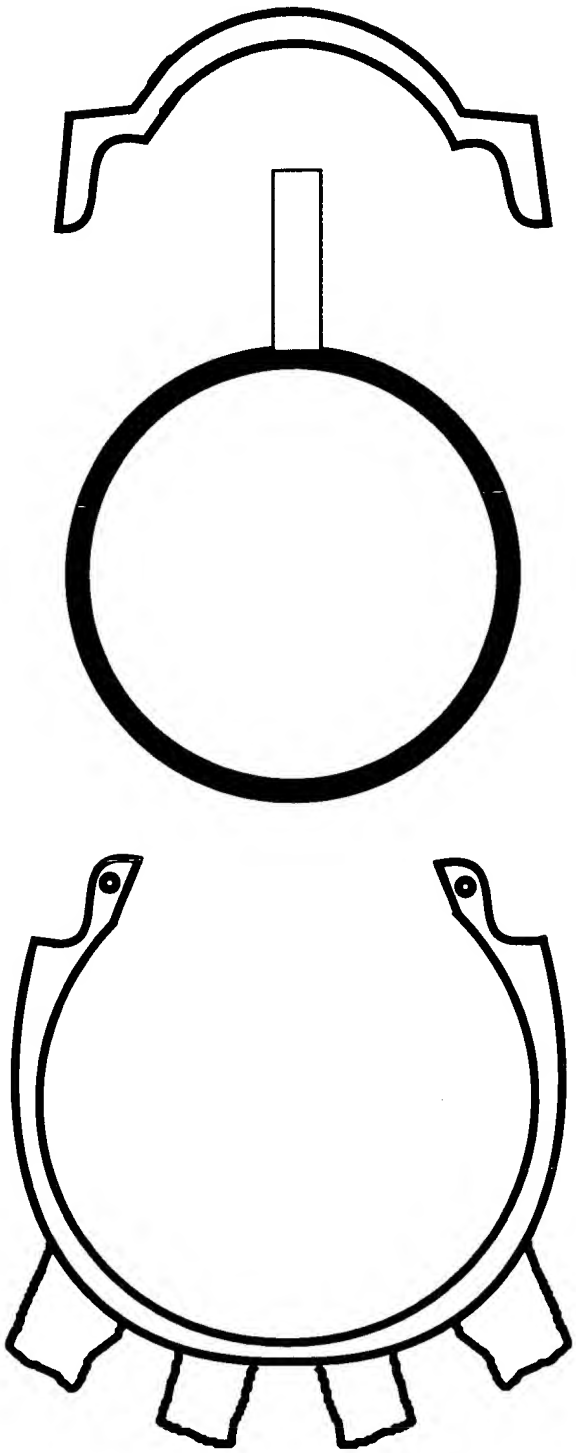


If it were possible to install the Krum stiff-end inflatable members as shown in the tire and rim, it will be impossible to work the remaining tire bead over the rim flange because, there will be a minimum of two of the inflatable members in direct interference with the bead entering into the rim recess.

If the tire bead cannot enter the rim recess for at least 180 degrees of the circumference of the rim there will not be enough perimeter of bead to allow it to pass over the rim flange.

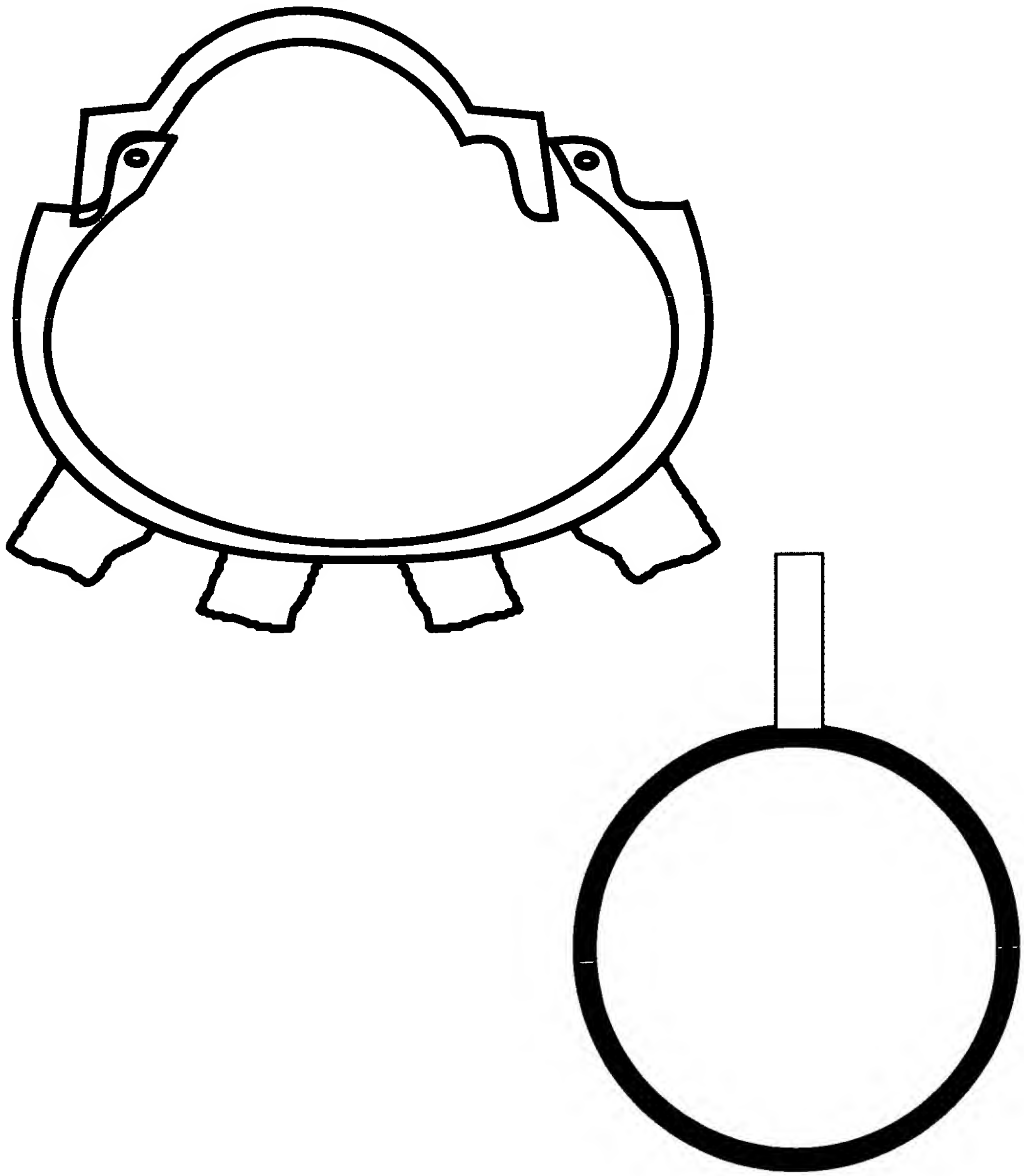
Thus it is impossible to take the teachings of Krum and apply it to a combination of a tire and modern “safety rim”.

Krum Inflatable Element and Modern Tire And Rim



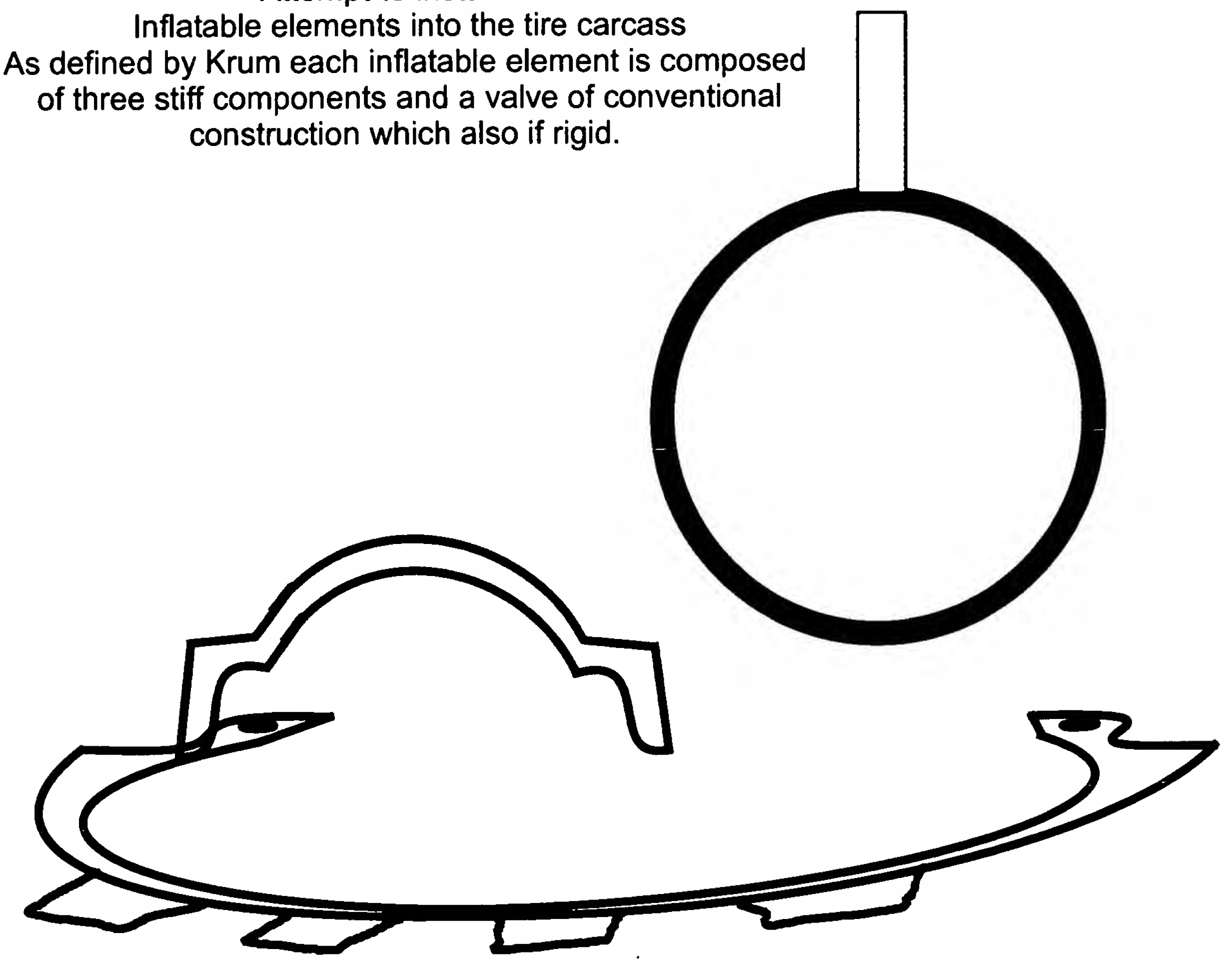
Krum Inflatable Element and Modern Tire And Rim

Step 1
Mount the first Tire Bead over the rim
Because the tire Carcass is in-extensible The profile widens and shortens in height



Krum Inflatable Element and Modern Tire And Rim

Step 2
Attempt to install the
Inflatable elements into the tire carcass
As defined by Krum each inflatable element is composed
of three stiff components and a valve of conventional
construction which also if rigid.



It is impossible for a modern tire carcass and modern rim!
In fact it might also be impossible for the older clencher tire and detachable rim flange..

Analytical Evaluation of Krum 952,675

Assumptions:

1. Tire is in the shape of a torus.

2. Drawings of Krum are to scale.

Equations and definitions of variables:

Volume of a Torus = $2\pi^2 R r_t^2$

Where R is radius from center of wheel to center of tire carcass, and r_t is radius of the torus cross-section which is also the same as the radius of the spherical elements and the inflatable elements.

Volume of a sphere = $4/3\ \pi r_t^3$

Volume of a cylinder = $\pi r_t^2\ h$

Where h is the height of the cylinder.

Dimensions as scaled from drawings

$R = 1.1618$

$r_t = 0.11$

deflated $h_1 = 0.067$

inflated $h_2 = 0.1954$

Volume of the tire carcass calculated using equation and dimensions scaled:
$2\ \pi^2\ R r_t^2 = 2\pi(1.1618)(0.11) = 0.2774$

Volume of each sphere as shown in Figure 1:
$4/3\ \pi r_t^3 = 4/3\ \pi\ (0.11)^3 = 0.005575$.

Volume of the inflatable elements in the un-inflated state as shown in Figure 1:
$\pi r_t^2\ h\ = \pi\ (0.11)^2\ (0.067) = 0.002547$.

Volume of the inflatable elements in the inflated state as shown in Figure 2:
$\pi r_t^2\ h\ = \pi\ (0.11)^2\ (0.1954) = 0.007427$.

The void volume of the tire carcass as shown in Figure 1 is equal to the volume of the tire carcass minus the volume occupied by the 32 spherical elements and the 4 un-inflated cylindrical elements.
0.2774 – (32x0.005575 + 4x0.002547) = 0.0889, which is 32% of the total tire carcass volume.

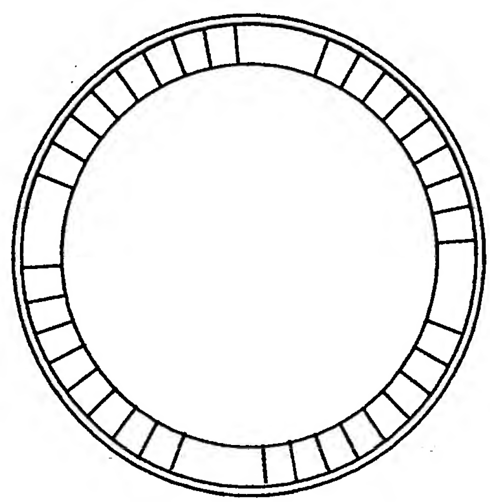
Figure 2 shows the inflatable elements expanded and the spherical elements deformed into cylindrical shapes, which results in complete filling of the tire carcass. Thus, the void volume of Figure 1 has been taken up by the increase in volume of the inflatable elements and the deformation of the spherical elements into cylindrical elements. As stated by Krum, it is the compression of the spherical elements by the expansion of the stiff ends of the inflatable elements that causes the deformation, thus causing the whole tire carcass to become filled. Assuming the most ideal conditions and materials of construction and using the Ideal gas law, the total increase in volume of the inflatable elements could only result in, at most, a comparable increase in volume of the deformed spherical elements.

Thus, the increase in volume of the inflatable elements must account for at least half of the reduction of the void volume as shown in Figure 2, or .0444, meaning that the volume of each inflatable element must have increased by 0.111. Thus, each inflatable element must now have a volume of:
0.002547 + 0.111= 0.013647.

Plugging that volume into the equation for calculating the volume of the cylindrical inflatable elements, $0.013647=\pi(0.11)^2 h$, the inflated height of the cylindrical inflatable elements is calculated to be 0.359, or 1.8 times what is shown in Figure 2 of Krum.

Thus realistically, Figure 2 should look more like this:

Krum Realistically
Figure 2



Original Location

Often ITRA receives phone calls, faxes, and e-mail requesting information on the history of retreading. It is unbelievable the number of calls received from university students and even primary age children preparing research on tire retreading and recycling.

The following is the first chapter in the ITRA publication, *Half-soles, Kettles, and Cures*. It may help anyone needing information in this area. The publication is available from ITRA for $16.95 and includes 116 pages filled with milestones in the tire retreading and repairing industry. The book features photos dating from a bicycle repair in 1897 to 1987 Facts.

The Early Years of Tire Retreading

Perhaps the most challenging aspect of the search through the history of the tire retreading and repairing industry is the quest for the "first" of the industry. To whom should credit go for the first tire repair, the first attempt at vulcanizing a repair, or the first successful retread?

It is fairly safe to assume that repairing began as soon as the first tire was placed upon the wheel of a vehicle; that it coincides with the history of the tire itself. Goodrich, Tew and Company (later reorganized as B.F. Goodrich) made solid rubber tires for high bicycles and by 1884, several companies had patented solid bicycle tires. A few years later, in the 1890's, Charles Miller patented a bicycle tire section mold reputed to be the first patent granted to the tire repair industry. In 1890, North British Rubber Company, Ltd. manufactured the first clincher tires.

In America, one of the most current sources of information about inventions and patents is the *Scientific American* magazine. Issues in the late nineteenth century featured photographs, articles, notes, and comments on the progress of the tire industry -- both bicycle and automobile; solid and pneumatic.

By the 1890's, each of the volumes in the magazine contained a list of patents for repairing compounds, tire rubber, inflatable and/or pneumatic tires, tire tighteners, tire covers, and puncture repairs of all kinds. Advertisements and articles were devoted to various aspects of the automobile and tire industries.

Concern for the protection of tires even reached city governments. In 1895, for example, Chicopee, Massachusetts, passed an ordinance whereby anyone found guilty of putting or placing any article that could injure or damage tires was subject to a fine of between $2 and $20 dollars. Horse drawn wagons caused damage accidentally when either a horseshoe or a wagon lost a nail along the road for the next unsuspecting motorist.

With an increased awareness of the road dangers to tires, there was an increase in the number of comments about repairing punctures. In one issue, an actual formula for puncture repairs was printed.

The recipe from a Mr. Zeitschrift reads as follows:

160 parts bisulphide of carbon

20 parts guttapercha

40 parts caoutchouc

10 parts isinglass

The compound or "cement" was dropped into crevices after they had been properly cleaned. If the tear was large, the cement was applied in layers. The tire was bound lightly with thread and left to dry for 24 to 26 hours. When it was dry, the thread was cut-off and any protruding cement was trimmed away with a knife that had been dipped in water.

This recipe and the detailed instructions for executing the tire repair appeared in the same September 14, 1895 issue as a series on the "smallest inventions" that had the greatest impact on society. Goodyear's discovery of vulcanization in 1839 and the pneumatic principle were both listed among the great discoveries. (Most sources agree that Goodyear and Thomas Hancock of England made simultaneous discoveries of vulcanization.) Goodyear's patent in 1844 was quickly followed by a number of patents for different forms of rubber including blankets, overshoes, and bands.

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The pneumatic principle is usually credited to John Boyd Dunlop of Belfast, whose experimentation with his son's tricycle tires in 1888 led to the discovery. As early as 1845, however, there was a brougham owned by an engineer of Middlesex, which had "noiseless tires" and created quite a sensation. Robert William Thomson patented these tires vulcanized with "sulphurized belts."

In the later part of the nineteenth century, there was a tremendous interest in rubber, rubber compounds, and inventions and a search for numerous applications. Rubber-tired wheels on ambulances began as an experiment in New York and proved to be advantageous over the iron wheel for the comfort of the patient and the horse drawing the ambulance wagon. This experiment in 1895 was to determine the value of rubber-tired wheels on ambulances. Two ambulances were used in the test, one with pneumatic tires and the other with solid rubber ones. Although both seemed to provide a smoother ride for patients than wooden or iron tires, there was no conclusion about which was more advantageous. The principle obstacle seemed to be the fact that the ambulances were extremely heavy vehicles designed to prevent easy jolting of patients. The pneumatic tires frequently collapsed from the weight while solid ones were torn from the wheels because of the strain. Nevertheless, the experiment received coverage in the magazine and the article suggested that they were going to continue using rubber in some form because of the smooth ride, in spite of all the disadvantages.

India Rubber Review magazine reported that credit for the first rubber tires actually belonged to J.G. Kellogg in 1863 who worked in the marble business. Apparently, A.T. Stewart (of dry goods fame and the President of Bank of America) was disturbed that the wheels of the trucks carrying rolled coins in the bank were causing severe damage to the marble floors. Stewart appealed to Kellogg to help save the floors. Kellogg vulcanized bands of rubber to the metal tires. The process was so successful that the same tires were still in use when the Review issue was published in 1902.

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The tremendous interest in rubber and pneumatic principles brought about a great deal of flexibility in the bicycle and, eventually, automobile industries. It is safe to assume that these same advances -- whereby a layer of vulcanized rubber surrounds a cushion of air led directly to the development of that layer of rubber incised into a tread and eventually to the very notion of "retreading" a tire.

But before retreading became an issue, there was increased concern about the safety of pneumatic tires and the prevention of punctures. In the 1890's, *Scientific American* published numerous patents and comments or descriptions for remedies to the dilemma. Examples included:

Patent No. 553,698 J.W. Mix. Mending punctures in pneumatic tires. No. 565,313 C.L. Pepper. Implement for repairing pneumatic tires. No. 566,772 G. Kirkegaard. Repair tool for pneumatic tires. No. 569,737 Hunt and Hostetter. Means for closing punctures in pneumatic tires.

Zebilon Foster of Chicago patented a "Protector for Pneumatic Tires" and explained it thus:

To prevent the puncture and damage of tires, the inventor provides a protective rim whose contiguous ends are enlarged and curved around the sides of the tire, being arranged one within the other and having their flat sides snugly engaged with each other. Each side of each end has an inwardly extending ear, the ears being longitudinally aligned, and being respectively engaged by threaded bolts and nuts to cause the rim to bind the tire.

The tire industry was experimenting, the bicycle and automobile industries were trying new ideas, and the turn of the century was fast approaching. Pneumatic tires for automobiles were first produced by Michelin in France. B.F. Goodrich was responsible for the first pneumatic tire in the U.S. in 1896 on a Winton automobile in Cleveland, Ohio. The age of the pneumatic tire was secure and the need for more efficient methods of increasing mileage, making repairs, and, as roads improved, retreading the tires had to be met.

By 1898, every issue of *Scientific American* magazine mentioned an entirely new set of patents pertaining to the tire industry, repairs, and puncture-protection. Numerous compounds, compositions, and cements were being used for repairing pneumatic tires. Christian Mathisen of Fredericksburg, Texas, patented a "tire-setting machine whereby a tire can be quickly set cold upon a rim." And, by 1899, an entire issue was devoted to the bicycle and automobile. That issue focused upon the fact that "Great strides have been made in the world of automobiles within the last eight years."

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The turn of the century brought about even more changes and "strides" in the automobile and tire industries. India Rubber Review was published for the first time in Chicago in November 1901 and contained a fascinating look at the tire industry of the early 1900's. (The *Review* was the predecessor of today's *Tire Review*, first published in September 1925 in Akron, Ohio.) Besides a variety of patents for pneumatic tires, valves, and inner tubes, there was a patent for "molding and vulcanizing India-rubber" applied for in Paris. An "airless" tire produced by Brooks Airless of Denver, Colorado had an interior core of India rubber which prevented punctures but still produced smooth riding qualities similar to pneumatic tires.

Edward Brice Killen of Belfast held a British patent (#19,321) for a non-puncturing pneumatic

tire which had a continuous unwearable tread. But the puncture problems still had most people convinced that the solid rubber tire was the only real option. King Edward of England had solid rubber tires on his automobile and B.F. Goodrich Company received an order for a set of solid rubber tires to be shipped to the Shah of Persia. Solid rubber truck tires were used in World War II and at least one electric-powered solid-tired truck was still in use in Pittsburgh as late as the 1950's.

According to *Scientific American*, solid rubber tires were secured to the wheels by a steel tape or pair of wires which ran through the tire. If the rubber was torn in a section, it could easily be removed and replaced with a section of a new or used tire and secured by the retaining wires. This seemed to have been the easiest and fastest method of tire repair.

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In October 1901, the National Retail Carriage and Harness Dealer's Protective Association held its twelfth annual meeting in New York. One of the features of the show was a rubber tire show. There were wired-on solid tires, cushions, and pneumatics, and exhibitors included, among others:

Brooke Airless Pneumatic Tire Company, Denver, Colorado

Calumet Tire Rubber Company, Chicago, Illinois

Consolidated Rubber/Kelly-Springfield

Diamond Rubber Company, Akron Firestone, Akron Goodyear Rubber Company, Victor Rubber Tire Company, Springfield

At the same time that there was an increased concern for the safety of tires and protection from blow-outs, there was a small group of independent entrepreneurs who were moving into the business of repairing tires using vulcanization. One of the earliest vulcanizers for repairing was patented in 1904 and the original Bacon electric steam vulcanizer was patented in 1908.

According to the reflections of Thomas Bacon, the electric steam vulcanizer came about while he was working with puncture and blowout repairs. Bacon was often frustrated by the fact that while repairing tubes he sometimes would forget about them for a few minutes while he was putting carbide in the lamp tank. By the time he remembered the tube, it had often melted into two pieces. Bacon decided that steam generated by electricity and held at a proper temperature would prevent this burning through. His invention was somewhat crude at first, but the regulator would automatically disconnect the current when it reached a certain pressure.

By 1910, *India Rubber Review* was printing regular advertisements for retreading and repairing equipment to the extent that the practices seemed commonplace. In 1903, the straight-sided tire replaced the need to have clinchers to lock over the rim, and by 1908, clinchers were virtually eliminated. The new tire was called the Quick-Detachable tire.

Where, in 1902, an appeal in *Scientific American* lamented the fact that automobile storage and repair facilities were too few and not yet satisfactory, by 1910 equipment was readily available for the entrepreneur to begin providing these much-needed services. In 1905, Henry Ford agreed to use Firestone tires on the Model T as original equipment when Firestone

agreed to establish "field branches" to repair and sell replacement tires to Ford car owners. Since the earliest tires only averaged about 1,000 miles, these first service stations stood to be very successful. In the first decade of the new century, several companies were founded and the industry was beginning to change technologically. In 1898, Goodyear Tire and Rubber Company was incorporated; in 1900, Firestone Tire and Rubber Company was organized; in 1900 the Rubber Manufacturers Association was founded; in 1901, Goodyear produced its first tire; in 1904, Seiberling-Stevens registered a patent for a tire-building machine; in 1907, the first taxicab was introduced in the U.S. and the Model T was marketed; in 1908, Goodyear adopted a diamond-shaped design in its tread and called it the "All Weather Tread." It became the symbol of the company for years.

***** *In the history of the English language, one often notes spelling variations in words that become associated with new industries. The tire industry is no exception. The word tire is spelled tyre in the British Commonwealth. Thomson's patent, however, even though it was English, was spelled with an i. See also, the appendix.***

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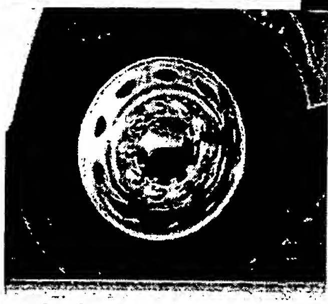

Tire Crash Statistics

- Each year, about 23,000 crashes are caused by tire blowouts
- Each year, 535 fatal crashes involve tire blowouts
- The risk of being involved in a tire blowout crash can be reduced by maintaining proper tire pressure, observing tire and vehicle load limits, avoiding road hazards, and inspecting tires for cuts, slashes, and irregularities
- Tire blowouts can occur by driving over a pothole or other object or by striking the curb when parking
- It is usually not possible to determine under inflation by visually inspecting a radial tire

Source: National Highway Traffic Safety Administration, TREAD Act Executive Summary (August 2001); NHTSA, Tire Safety Brochure (October 2001)

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Investigators say tire debris may have ruptured Concorde fuel tank

July 31, 2000
Web posted at: 11:38 a.m. EDT (1538 GMT)


(AP PHOTO)
Tires lie amid the wreckage of Concorde Flight 4590

LONDON (CNN) -- The investigation into the crash of Air France Concorde Flight 4509 is increasingly focusing on the aircraft's tires, with experts saying debris from a blowout on the left-hand side of the plane could have ruptured a fuel tank in the aircraft's wing.

Concorde has suffered a succession of tire blowouts since it started operating commercially in 1976.

The high speed at which the aircraft takes off and lands -- 250 mph -- means that the damage caused by blowouts can potentially be more severe than that on normal planes.

In 1979, two tires on an Air France Concorde exploded as it was taking off from Dulles Airport in Washington, damaging the plane's No. 2 engine, rupturing three fuel tanks, and damaging hydraulic cables and fuel wires.

There are reported to have been at least six further serious tire failures on Air France Concordes. In the same period, there have been 12 tire blowouts on British Airways Concordes, although only two were classified as dangerous.

ALSO
- Concorde safety meeting follows new alerts

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Anatomy of a Concorde engine

Anatomy of a crash

CONCORDE CRASH
- Anatomy of the Concorde (Shockwave needed)

Reinforced rubber

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Each Concorde has eight main wheels and two nose wheels. Air France Concordes use American-made Goodyear tires. British Airways Concordes use British-made Dunlop tires.

The tires are made from specially reinforced rubber and nylon, and measure 47 inches (119 centimeters) in diameter by 15.75 inches (40 centimeters) in width. The nose wheels are each 31 inches (78 centimeters) by 10.75 inches (27 centimeters).

They are attached to the alloy wheel-rim with high-tensile steel wire, and inflated with nitrogen to 183 pounds per square inch, roughly six times the pressure of the average car tire.

Nitrogen is used rather than air because it ensures a stable pressure under extreme conditions.

Warning light

A red warning light has been installed in Concorde cockpits to alert the pilot to any tire problems during takeoff. The light is only activated if the aircraft is traveling at less than 150 mph, however. Any faster than that and the plane cannot stop, and so the light remains off.

Jean-Paul Villeneuve, of France's air accident investigation bureau, the Bureau Enquete Accident, said: "The tires are just one of many elements we are investigating. We have, however, found fragments of rubber and metal from one or possibly two of the aircraft's tires on and around the runway at Charles de Gaulle. This would suggest that there was some sort of blowout prior to takeoff."

Dick Downs, editor of Avionics Magazine and a former pilot, said: "It's certainly possible that a blowout could have been the cause of the tragedy. It's important not to be alarmist, however, and imagine there's some inherent design fault in Concorde's tires.

"It has had blowouts before, but then so have all planes. Twenty-odd incidents in 20 years doesn't strike me as a particularly high total, especially for a high-performance aircraft like that."

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Jury Awards $30.7 Million To Girl Left in Vegetative State After Ford Van Rolls Over

In 2000, a Florida State Court jury before the 11th Judicial Circuit Court awarded Ramon and Maria Jimenez, on behalf of their young daughter Phoebe, a $30.7 million against the Ford Motor Company. The jury found Ford guilty of manufacturing a defect in the tire valve on the 1999 Ford Econoline 15-passenger van, which rolled over on top of Phoebe.

"She is in an almost complete vegetative state and the worst part is she is that she is aware of her condition," said Ervin A. Gonzalez, who tried the case along with Colson Hicks Eidson partner Mike Eidson and Gonzalo Dorta, with Gonzalo Dorta, P.A.

In May of 1999, Ramon Jimenez rented a brand-new Ford Econoline 15-passenger van to drive his family to Walt Disney World in Orlando to celebrate Phoebe's tenth birthday. While the family approached their destination, the right-rear tire failed on the Ford van as a result of a tire valve defect and the van's inherent instability. The tire's valve was torn, allowing air to leak out of the tire. The tire was driven low on air causing the tire to overheat and explode. The driver lost control due to the instability of the 15-passenger van, and the van rolled over-landing on Phoebe, causing her to suffer a severe injury to the brain.

"Ford's neglect and gross irresponsibility continues to plague the nation and we will not stand for it," added Eidson, who is also co-lead counsel in the national class action against Ford and Firestone.

"The National Highway and Traffic Safety Administration (NHTSA) issued a report that said that these vans are 3 times more likely to roll over when there are more than 10 people in them," said Gonzalez. "Accordingly, NHTSA recommend special training to drive the vans. Our van had 12 people in it and there was no advice of a need for special training to drive it. Ford never told anyone

Client error '800a13

Client:An unanticipat
error occurred during
processing of this
request.
HRESULT=0x800A1
- Client:Sending the
Soap message failed
no recognizable
response was receiv
HRESULT=0x800A1
- Client:Unspecified
client error.
HRESULT=0x800A1

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line 34

and now the Jimenez family has to pay the consequences for Ford's neglect."

Attorneys for the Jimenez family were Ervin Gonzalez and Mike Eidson.

Ford settles tire lawsuits quietly
Automaker spends millions to protect Explorer's image

By Mark Truby / The Detroit News

DEARBORN -- Ford Motor Co., while publicly claiming its best-selling sport-utility vehicle is not to blame, is paying out huge settlements to people injured or killed in accidents involving the Ford Explorer equipped with Firestone tires.

Ford and Bridgestone/Firestone Inc. face about 400 personal injury and product liability lawsuits in state and federal courts. So far, more than 100 cases have been settled, attorneys estimate.

Most of the lawsuits stem from accidents in which the tread peeled off Firestone tires, leading to rollover accidents in Explorers.

Plaintiffs' lawyers say Ford has been unusually aggressive in settling the cases and has been willing to pay millions of dollars to avoid trials.

In several cases, Ford has settled with victims before a lawsuit was filed.

"I have never seen anything like this in my life," said Mike Eidson, a Coral Gables, Fla., lawyer representing several plaintiffs suing Ford and Bridgestone/Firestone.

"Not in a million years would you see a company settling cases like this."

By settling cases quickly and quietly, Ford heads off a series of lengthy, high-profile court battles that could lead to big jury verdicts and further tarnish the image of the Explorer, which generates huge profits for Ford.

"For Ford, it's a simple business equation," said Sean Kane, head of the litigation research firm Strategic Safety in Arlington, Va. "It's worth the premium for them to clear the Explorer and stop the discovery process in these cases."

Firestone slow to settle

Bridgestone/Firestone Inc. has been less eager to settle, typically allowing Ford to come to terms with a plaintiff before entering negotiations, lawyers say.

The amount of the settlements vary widely depending on the jurisdiction of the case and other factors, such as a victim's future earnings potential, age and number of dependents.

Experts and lawyers involved in the cases estimate that Ford and Firestone are paying no less than $1 million and usually between $3 million and $6 million in the majority of cases where a death is involved.

Settlements of $10 million or more are not uncommon in cases where paralysis is involved because of the high cost of medical bills.

In each case, defendants agree not to disclose how much money they received and Ford does not admit any blame or liability. But trial lawyers say Ford's offers are often too good to turn down and clearly show the automaker isn't comfortable arguing its case before a jury.

"The question is: Why would a company that had no fault at all pay out millions of dollars in settlements?" said Bill Frates, a lawyer in Vero Beach, Fla., who is handling several suits against Ford and Firestone.

Best option, Nasser says

Ford President Jacques Nasser said in a recent interview that settling the cases is usually the best option for Ford and plaintiffs.

"If we can reach a compromise, a fair compromise with our customers where they have some certainty and they have some peace of mind, that to us is a much better situation than going into a legal court trial," Nasser said.

"You'd like to get it behind you and that's what we would like to do."

The federal government has linked 174 highway deaths and more than 700 injuries to accidents involving Firestone tires, mostly mounted on Explorers.

Ford disclosed in its latest annual financial report that Firestone-related lawsuits pending against the company seek a total of $590 million.

But the figure is deceptively low because it represents only lawsuits that specify the exact amount of money sought by plaintiffs.

Deals often preferred

Settlements are often preferable to a prolonged legal battle on both sides of a lawsuit. Plaintiffs get money right away and limit legal costs.

For defendants, the settlements eliminate the possibility of giant jury awards against the automaker. Ford and other carmakers have been burned by blockbuster verdicts in the past.

In 1978, a jury awarded $128 million to the plaintiffs in a case where one person died and another was burned when the gas tank of their Ford Pinto exploded.

And in 1999, General Motors Corp. was hit with a $4.9-billion jury verdict because of an alleged design flaw on the 1979 Chevy Malibu. The award was later reduced to $1.2 billion.

Ford's legal position could be weakened by its public feuding with Bridgestone/Firestone -- with both companies releasing data that purportedly shows the other company is at fault.

"Before they were protecting each other in court filings," said Robert Darling, who represents Chuck Burt.

Burt was paralyzed from the waist down last June when the right-rear tire -- a Firestone ATX -- on his 1991 Ford Explorer peeled apart, sending the sport-utility into a rollover accident on Interstate 96 in Livingston County.

More fireworks expected

About 250 federal personal-injury lawsuits and class-action cases have been consolidated for discovery before U.S. District Judge Sarah Evans Barker in Indianapolis.

Lawyers in the case are scheduled to depose Bridgestone/Firestone chief executive John Lampe on Monday. Nasser's deposition is set for July 20 in Dearborn.

"It's going to be a very, very hot deposition," said Eidson, a lead attorney in the litigation.

No Ford-Firestone lawsuits have gone to trial yet. Ford typically accelerates negotiations toward a settlement when trial dates approach.

Hours before her trial was set to began, Donna Bailey of Portland, Texas, accepted a settlement offer from Ford and Bridgestone/Firestone.

Bailey, 44, suffered a spinal cord injury that paralyzed her from the neck down after the two-door Ford Explorer in which she was riding crashed March 10, 2000, near Poth, Texas.

The terms were not disclosed, but published reports estimate that Bailey got between $20 million to $35 million.

Ford changes stance

Prior to the cases involving Firestone tires, Ford was known as a tough negotiator in product liability cases.

The automaker has deep pockets, a large, veteran legal staff and plenty of experience with big-time litigation. The automaker often fights lawsuits for years, exhausting every legal option, to avert a large payout.

Adam Studnicki, a Phoenix, Ariz., lawyer, was braced for a long, difficult battle with Ford.

He filed three lawsuits this year and was poised to file eight more suits stemming from rollover accidents involving the Explorer and Firestone tires. Five people were killed in the accidents and 26 were injured.

On May 23, Studnicki met face-to-face with Ford's lawyers for the first time. By the end of the day, all

11 suits were settled.

Negotiations that would normally take weeks and months, were completed in hours. The deals were cut without depositions, mediation sessions or the usual flurry of paperwork flying back and forth.

"They were very willing to talk and they were very aggressive about settling these cases," Studnicki said.

Nasser said Ford will not hesitate to go to trial if a settlement cannot be reached. Legal experts say Ford is likely to hand-pick a case where the company has a good chance to win.

"Ford is not scared of a trial if they think they have a good chance of winning," said Roger Braugh, a Corpus Christi, Texas, lawyer handling more than 60 cases against Ford and Bridgestone/Firestone. "So that should tell you a lot about all these cases they are settling."

In first trial, Firestone settles lawsuit

With a jury deliberating, Bridgestone/Firestone agrees to pay $7.5-million to the family of a Texas woman paralyzed in a rollover.

©Associated Press

McALLEN, Texas -- The first trial to come out of the Firestone tire debacle ended abruptly in a settlement Friday, with Bridgestone/Firestone Inc. agreeing to pay a reported $7.5-million to the family of a woman paralyzed in the rollover crash of a Ford Explorer.

The settlement was announced shortly after the jury began a fourth day of deliberations in the closely watched $1-billion federal lawsuit.

The amount was not disclosed, but the Associated Press, citing two sources familiar with the settlement, reported that it was worth $7.5-million.

"Our mission here, for our family, was to make sure no other person suffered like our family did," said Dr. Joel Rodriguez, whose 39-year-old wife, Marisa, was paralyzed and brain-damaged when the Explorer crashed on a Mexican road last year. "We feel that our objective has been met."

Bridgestone/Firestone had blamed the accident on the Explorer, saying design flaws made it prone to rolling over.

In settling the case, it admitted no liability.

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It was not known which way the jurors were leaning before deliberations were cut short. They were escorted out of the courtroom and their names were sealed by U.S. District Judge Filemon Vela, who recommended they not talk about the case because it could affect other lawsuits.

The case was the first Firestone lawsuit to go to trial since the recall last summer of 6.5-million of the tires. Federal officials have linked more than 200 deaths to accidents involving Firestones on Explorers.

Bridgestone/Firestone has settled about 200 cases and has some 300 still pending. Ford settled with the Rodriguezes for $6-million before trial. With more cases pending, the Texas trial had drawn scrutiny as the industry and personal-injury lawyers watched to see whether Bridgestone/Firestone could persuade a jury to assign at least some of the blame for the accident to Ford.

Rodriguez's brother, Jorge Rodriguez, was driving the Explorer on a family trip in March 2000 when the steel belt and tread on the right rear tire tore apart. The vehicle rolled three times, crushing the roof.

Rodriguez testified that his once-vibrant wife now spends her days sitting at a table or watching television, a frightening sight to her three children, including 4-year-old Joel Jr.

"He wouldn't even climb up to the bed or be near her because he was scared. He would tell me, "My mama is dead,"' Rodriguez said.

Firestone lawyer Knox Nunnally said he thinks the company illustrated that Ford was to blame.

"The message anyone I believe would get out of this trial if they sat through all of the evidence is that (the Rodriguezes') Firestone tire was not the problem," he said.

A Ford spokeswoman declined comment, but analysts didn't completely agree with Nunnally's assessment.

"This could be read by consumers that Bridgestone/Firestone had the chance to prove it wasn't all their fault, and they blinked," said Michael Flynn, director of the Office for the Study of

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Automotive Transportation at the University of Michigan.

Rodriguez's lawyers argued that Firestone officials knew the tread on the Wilderness AT tire was more likely to separate but rejected inexpensive changes to fix the problem, including 90-cent nylon strips.

"This tire has killed more people than Timothy McVeigh. That is the awesome nature of the tragedy," said Mikal Watts, a lawyer for the family.

Bridgestone/Firestone said the tire was fine when it left the factory but began to tear apart after the Explorer ran over a baseball-size object. Chief executive John Lampe testified that tread separation is not uncommon and that other vehicles could have pulled over safely after a tire failure.

"We are glad we were able to reach a resolution with the Rodriguez family," the tire company said in a statement. "Since the outset, when we provided financial assistance to help with the family's medical bills, we have been hopeful that we could reach a fair settlement that would also bring closure to them following this accident."

In addition to the $7.5-million agreed upon Friday, Bridgestone/Firestone gave the family $350,000 upfront to help pay medical expenses.

Tab Turner, one of Rodriguez's lawyers, predicted more contentious litigation. Two suits that challenge Ford and Firestone are scheduled for state court on Sept. 10.

"These cases are not all identical," Turner said. "Some of these cases are more Ford cases than they are Firestone cases. There's going to be trials and there's going to be verdicts."

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In the U.S. Patent and Trademark Office

U.S. Patent Application S.N. 09/879,709

Title: Tire Inflated With A Plurality Of Balls

Filing Date: June 12, 2001

Group Art Unit: 1733

Examiner: Justin R. Fischer

Declaration of Wade Summers

I, Wade Summers, hereby declare the following:

1. I am the inventor of the invention described in the referenced patent application.

2. As a boy of fifteen, I began work at a service station where I was first exposed to changing of automobile, truck and farm equipment tires. Back in those days, there still were detachable truck rims. Through my 30+ years of motorcycle racing, I have changed many tires, including those inflated by foam inserts. I have a great deal of experience with the mounting of tires onto a variety of rims. Inserting an inner tube with its rigid valve stem and or a rim lock with its rigid bolt into a rim hole is only possible because the inner tube is flexible and the body of the rim lock only partially fills the tire carcass. The total length of the stem/bolt and rigid components must be less than the height of the tire carcass and rim recess; otherwise it would be physically impossible to install.

3. I have reviewed U.S. Patent No. 952,675 "Krum", and I think the Krum design would be unacceptable to consumers, even assuming that it would be able to function as described, due to the very rough ride it would produce, as will be explained below. For that reason, a person of ordinary skill in the art would be likely to reject the Krum design and would not be inclined to try to modify it to fit onto a modern safety rim.

4. Even if a person were inclined to try to mount the Krum tire onto a safety rim, I believe it would be impossible to accomplish the mounting, both because the inflatable members "C" could not be inserted between the tire and the rim and because the inflatable members "C", if installed, would prevent the tire bead from being able to be recessed into the rim sufficiently to permit mounting, as is explained below.

5. Attached are some drawings I have done to illustrate what is required to mount a tire onto a safety rim. On page 1 of the attachment, I show a safety rim, which has a U-shaped cross-section, with a recessed center and recesses on the sides that receive the edges of a tire (the tire bead).

6. On page 2, I show how the tire bead (what we have called a cord in my patent application) is worked over the flange of the safety rim. The bead first is placed over the bottom portion of the rim, and then the bead enters the recessed center of the bottom and side portions, giving it just enough room to fit over the flange at the top of the rim.

7. As shown in the Krum patent, the inflatable members C include rigid circular ends and a rigid cylindrical center. When the inflatable members C are inflated, the ends move away from the center and compress the balls. In order for Krum's inflatable members C to compress the balls to the shape shown in Figure 2 of Krum, there would have to be several inflatable members C. According to my calculations, which are attached hereto under the heading "Analytical Evaluation of Krum 952,675, beginning on page 7 of the attachment, the inflatable members C in the design shown in Figure 1 of Krum would have to inflate to about twice the dimension shown in Figure 2 (or there would have to be twice as many inflatable members) in order to achieve the change in volume in the balls that is shown. In my drawing on page 3, I have shown only three of the inflatable members C. While Krum simply says there is a "plurality of inflatable elements C" and does not specify the minimum number that could be used, it is clear from my calculations that there would have to be many of these elements, certainly more than three, in order to achieve the desired compression of the balls.

8. Looking at page 3 of my drawings, I show that the first tire bead is worked onto the safety rim in the usual way. Assuming that the inflatable members then could be inserted (which I do not believe is possible, as explained below), it would next be necessary to mount the other bead of the tire onto the safety rim. However, it would be impossible to mount the other bead onto the rim, because the inflatable members C substantially fill the central recess of the rim and thus would prevent the bead from being recessed into the center of the rim to provide sufficient slack to fit the rest of the bead over the flange of the rim.

9. I have tried to mount my tire on a rim using three equally-spaced rim locks, and I have found that it cannot be done. In order for the tire to fit over the rim, it is necessary for part of the tire to be recessed up into the rim to create the space to fit the remainder of the tire over the rim. If I use two or fewer rim locks, giving me at least 180° of freedom, I can mount the tire. However, if three equally-spaced rim locks are used, leaving only 120° between the rim locks, it is not possible to recess enough of the tire up into the rim to create enough room to fit the tire over the rim. Therefore, I know from testing that it is necessary to have more than 120° of free space into which the edge of the tire can be recessed into the rim in order to mount a tire onto a safety rim. The inflatable members "C" would provide an even greater barrier than the rim locks I have used, so the situation would be even worse in trying to mount the design of Krum on to a safety rim.

10. Page 4 of my drawings shows the Krum inflatable element in conjunction with a modern tire and safety rim. Pages 5 and 6 of my drawings show that, in order to put the rigid inflatable member inside the partially-installed tire and rim, it would be necessary to create a large opening between the remaining tire bead and the rim, which is not possible,

since the remaining tire bead cannot stretch. Thus, installation of Krum's design onto a one-piece safety rim is impossible for two reasons: first, because the inflatable elements cannot be installed and second, because the tire bead would not be able to fit over the rim with the inflatable elements installed.

11. My analysis of the volumes in the Krum design, based on the drawings of Krum, are shown beginning on page 7 of the attachment. As explained in that analysis, the volume increase of the inflatable members C would have to be about twice what is shown in the drawings of Krum. This means that, either each of the inflatable members C would be about twice as long as is shown in Figure 2 of Krum, or there would have to be about twice as many of the inflatable members C – or eight of these members rather than the four that are shown.

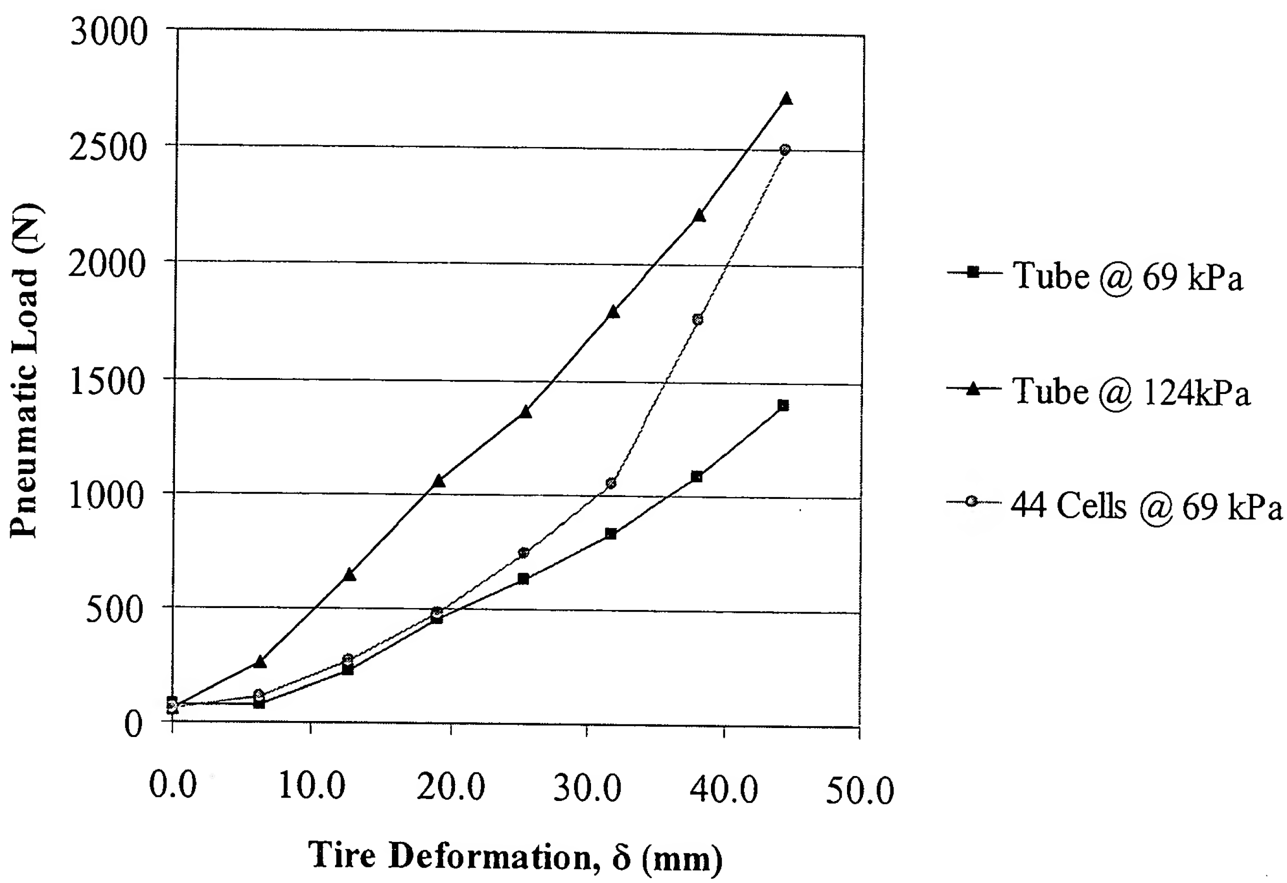
12. In order for Krum to achieve the expansion shown in his Figure 2, the air trapped between the expandable elements and the spherical elements and within the tire carcass must be allowed to escape into the atmosphere. If the tire is mounted onto a safety rim, with a seal between the tire and the rim, that would be impossible.

13. Imagine riding on the tires of Krum. Each time the rigid portions of the inflatable elements "C" come into contact with the ground, there is a jolt or bump, with the tire having no resilience. This would be completely unacceptable for modern transportation. I have conducted extensive literature research on the history of the pneumatic tire, and I have found no mention of Krum or of any product of the type described by Krum. This does not surprise me, given the unacceptability of the type of ride that would be provided by Krum's design, even if one assumes that the design would function as described.

14. Since the Krum design, at best, would give a very rough ride, as explained above, a person of ordinary skill in the art would not be inclined to try to adapt that design to modern safety rims. If such an attempt were made, it would be physically impossible to mount the Krum design onto a safety rim, as explained above.

15. I have also reviewed the Peck and Grubb references, which were cited by the Patent Office. Both of these designs include spacers that prevent the balls from shifting circumferentially inside the tire. Thus, these designs would not be effective at continuing to support the load if one or more of the balls is punctured and deflates.

16. The use of my design has proven to be quite beneficial in performance as well as being virtually flat-proof. Experimental static stiffness data was collected for a commercially available 21-inch off-road motorcycle tire inflated with a traditional inner tube at two different pressures (69 and 124 kPa) as well as with 44 balls (inflated to 69 kPa each). The results are shown below.



17. The graph above shows that both traction and suspension capacity of the tire inflated with balls as described in my patent application are substantially improved over a traditional inner tube or tube-less inflation. My design deflects at lower loads like an inner tube at a low pressure, providing a large contact patch, good traction, and good absorption of small bumps. At higher loads, it deflects like an inner tube at a higher pressure, allowing it to absorb higher loads with greater resistance to bottoming out.

18. All terrain vehicle users find even more benefits in cornering stability not found with traditionally inflated tires. In the last several national pro-level competitions, riders/competitors using my system have won overall titles. Top level off road motorcyclists also have been quite successful using the product. One competitor successfully completed an event without knowing that seven of the 48 cells had been damaged. This fact was discovered only after the event, when a new tire was being fitted to the wheel. In the most recent event, a competitor who has been in retirement produced the quickest lap times using the multiple inflation cell system. This fact is another remarkable achievement and strong endorsement of the unique performance advantages of this system.

19. I hereby declare that all statements made herein of my knowledge are true, all statements made herein on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and may jeopardize the validity of the application or any patent issuing thereon.

Wade Summers — 10-23-03
Date